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NOTES ON LAND SLUGS OF LOS ANGELES AND ORANGE COUNTIES, CALIFORNIA

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Though during the past 23 years much collecting of non-marine mollusks has been done by the writer in this area, it has been only during the past three years that a particular effort has been made to study the local land slugs. Our present knowledge of this group as represented in Los Angeles and Orange Counties, California, includes eight species. Of these, six species belong to the family Limacidae. Two species, *Anadenulus cockerelli* (Hemphill) and *Hesperarion hemphilli* (Binney), belong to the Arionidae. We have three indigenous species of slugs. Five species, all belonging to the Limacidae, have been introduced.

LIMAX MAXIMUS Linnaeus

Though relatively common in the San Francisco Bay region, records from southern California are few. Since it was formerly confused with *Limax marginatus*, at least some of the older records are no doubt referable to that species. The writer has never taken it in southern California. A single specimen in the Los Angeles Museum collection (No. 104) bears the following data, "Hallenbeck Park, Los Angeles, Calif., Dec. 4, 1923. Gordon Grant, collector." Live specimens collected by A. G. Smith in Golden Gate Park, San Francisco, Calif., were exhibited at the May, 1943 meeting of the Conchological Club of Southern California. No member present recalled having ever seen it in southern California. Mabel Guernsey¹ reported it as common at Laguna Beach, Orange County, Calif. Her statement, "*Li-*

¹ First Annual Report of the Laguna Marine Laboratory, Pomona College, p. 81, May, 1912.

max maximus is, when fully grown, about two inches long; *Limax flavus* is somewhat smaller," would indicate that she was unfamiliar with the species mentioned and that she was dealing with other slugs. In later years both Morris Caruthers and the writer have failed to find *L. maximus* at Laguna Beach.

It is said by some authors that this species will not eat green chlorophyllaceous vegetable matter. Specimens of *L. maximus* which I had in confinement did eat the dark green leaves of romaine. In addition to various tender vegetables they also ate raw beef and were observed to attack and readily devour live specimens of *Deroceras agreste* and *Arion intermedius*.

LIMAX FLAVUS Linnaeus

This is the largest of our common slugs in southern California. An unusually large specimen (preserved in 4% formaldehyde) collected in my yard at 2200 S. Harvard Blvd., Los Angeles, measures $4\frac{3}{8}$ inches (112 mm.) in length. In a yard in Long Beach, I found a colony of about three dozen individuals which made their home in a fissure in the earth about eight inches deep. At night they would come out and crawl about the yard in search of bits of garbage. It is fond of fungus growths and is commonly found about rotten wood. I have frequently taken it in a cavity in a rotten log. At one time I examined a rotten tree trunk immediately after it had blown down and this species and *Limax marginatus* were found in cavities in the wood at least 12 feet from the bottom of the trunk. There were numerous slime trails over the outside of the bark. It is fond of tender vegetables and specimens in captivity have readily eaten lettuce, romaine, cabbage, carrot, potato and turnip. It was particularly found of romaine root.

A single specimen taken in El Monte, Calif., May 1, 1942, and which when fully extended to slender proportions measured 25 mm. long (approximately 30 days old) was placed in confinement and isolated from other slugs. It was fed principally on lettuce. It was approximately $2\frac{1}{2}$ inches long on December 26, 1943 (about 634 days or 21 months old). On this date two eggs were deposited. Apparently self-fertilization had taken place as the eggs hatched 15 days later. On January 23, 1944, three more eggs were deposited but these were sterile. The two young specimens have since continued to grow.

I have personally collected *Limax flavus* from numerous localities in Santa Barbara, San Bernardino, Los Angeles and Orange Counties.

LIMAX MARGINATUS Müller

This species is second only to *Deroceras agreste* in its abundance and wide distribution in southern California. The writer has personally collected *Limax marginatus* from numerous localities in Santa Barbara, San Bernardino, Riverside, Los Angeles and Orange Counties. The collection of the California Academy of Sciences contains specimens from as far north as Kirkwood, Tehama County, California. In spite of its abundance and wide distribution, there are, to date, but two published records of its occurrence in North America. In 1917, Cockerell reported it from a greenhouse in Boulder, Colorado;² and again in 1930, he reported it from Santa Catalina Island.³ The lack of records of this slug seems due to its confusion with certain color forms of *Limax maximus*. Internally *L. marginatus* is characterized by a posteriorly directed rectal caecum and a digitiform appendicular structure which is attached to the penis. Both of these structures are absent in *L. maximus*.

Specimens in confinement fed on decayed wood, lettuce, potato, turnip, cabbage and calla lily flowers. A lady once told me that something was ruining her calla lilies and that she suspected that the damage was being done by slugs. A few days later I received from her a small box containing two or three calla lily flowers. The slugs (*L. marginatus*) were there too, still eating.

Another interesting observation on *Limax marginatus* is the tendency to auto-urotomy, or self-amputation of the posterior end of the body. I have frequently noticed specimens in my yard with a noticeable constriction about three-fourths of the distance back from the posterior edge of the mantle. A specimen taken from my yard on May 30, 1943, showed this constriction quite pronounced with the area posterior to it shrunken as if from atrophy resulting from restricted circulation. The specimen was confined and furnished an abundance of food.

² Nautilus, vol. 30, p. 120, February, 1917.

³ Ibid., vol. 52, p. 136, April, 1939.

Two weeks later the posterior end was quite filled out but a remaining slight constriction was definitely noticeable. When the slug was handled the constriction again became more pronounced. The only instances observed of complete self-amputation of the posterior portion of the body have been in specimens while in the drowning jar. I have before me a set of eleven specimens of *L. marginatus* taken in my yard on November 15, 1941. After drowning they were preserved in alcohol. Of these eleven, three show no signs of constriction; four show definite evidence of constriction; two are short with blunt posterior extremities, suggesting constriction when very young with consequent non-development of their tails; two, with definite constriction at time of collecting, accomplished complete self-amputation of their tails while in the drowning jar. Though this habit in *Prophysaon* has long attracted attention, it has apparently been overlooked in *Limax marginatus*.

DEROCERAS AGRESTE (Linnaeus)

In southern California this is by far the most abundant species of slug, both in numbers and in locality records. There are numerous color forms which are united by complete intergradation. Interbreeding has been observed to take place between diverse color forms indiscriminately. Internally the species is characterized by a many lobed penial gland and by the presence of a rectal caecum. The penial gland varies greatly. There is absolutely no relation between the variation in color and the variation of the penial gland. Though described as having a pointed tail, certain of the fully mature individuals have a somewhat chisel-shaped tail resembling in this respect *Deroceras laeve* (Müller). Some of our color forms have been confused with *D. laeve*. The latter may be readily distinguished by the absence of a rectal caecum. *Deroceras agreste* usually exudes milky slime when handled roughly while *laeve* exudes clear colorless slime at all times. Though abundant in the San Francisco Bay region, I know of no instance of the occurrence of *Deroceras laeve* in southern California.

DEROCERAS GRACILE (Rafinesque)

This slug is quite generally distributed over Los Angeles and Orange Counties though I have at no place found it abundant.

This species has been confused with *Deroceras laeve*. *D. gracile* is smaller, more slender; has a pointed tail while *D. laeve* has a chisel-shaped tail when viewed in profile. The penis of *D. gracile* is spiral in form while that of *D. laeve* is hammer-shaped with three or four tubular glands. These differences were constant in all specimens examined in which there were fully developed male genitalia. The difficulty in making these determinations is that most specimens collected are in the female phase. In this female phase the female reproductive organs are mature and egg production has begun although male reproductive organs have not yet developed. Many individuals die after a period of active egg production and before the male genitalia have developed. Apparently only a small percentage of specimens enter the hermaphroditic phase in which the male organs as well as the female organs are fully developed. It is believed by some that there is an atrophy of the female organs resulting in a purely male phase. The numerous specimens which I have examined were either female or hermaphrodite. What is said here of these sex phases applies equally to both *gracile* and *laeve*. The truncate or chisel-shaped tail of *D. laeve* is to be looked for only in specimens approaching their maximum size. These large specimens with truncate tails have fully developed male genitalia. In my comparative study of these two species, which is by no means complete, I have utilized numerous living specimens of *D. laeve* from the San Francisco Bay region kindly furnished by Allyn Smith.

Specimens of *Deroceras gracile* from Los Angeles and Orange Counties are generally of a light slate gray with a gelatinous appearance although in some colonies the specimens are nearly black with the dark pigment diffused over a dark brown background.

MILAX GAGATES (Draparnaud)

Fairly common. Specimens have been collected in Santa Barbara, Los Angeles, Orange and San Diego Counties. Most of these varied from dark gray to nearly black. The lighter colored specimens were more heavily pigmented along the longitudinal grooves. Specimens from Refugio Canyon, Santa Barbara County, were much lighter than any of the others with a

decided yellowish cast while the slugs were living but less noticeable in the preserved specimens. A single large specimen from Elysian Park, Los Angeles, had a definite dorsal stripe of the keel, suggesting *M. sowerbii* (Férussac). It had the characteristic globose spermatheca which would identify it as *gagates*.

ANADENULUS COCKERELLI (Hemphill)

When originally described the type locality was given as Cuyamaca Mts., San Diego County, Calif. Hemphill's types, now in the California Academy of Sciences, are indicated as being from "Julian, San Diego County, Calif." For over fifty years *Anadenulus* was known only from the type lot originally collected by Henry Hemphill. The writer has succeeded in finding specimens at the following localities: Upper Millard Canyon, San Gabriel Mts., Los Angeles County; Calbaden Canyon, Puente Hills, Los Angeles County; Carbon Canyon, Puente Hills, Orange County; Limestone Creek above Santiago Reservoir, Orange County.

This species bears a superficial resemblance to a small specimen of *Prophysaon andersoni* but the tripartite sole of *Anadenulus* is sufficient for easy recognition. One specimen, apparently fully adult, measures 28 mm. long when fully extended. The longest preserved specimen in my collection measures 20 mm. The color varies. Some individuals are nearly black. Young specimens are generally darker than adult specimens. There are generally two undulating longitudinal yellow stripes on the mantle. These may be bordered on either side by black stripes. In a specimen from Millard Canyon the outer black stripes are conspicuous with the area between the two yellow stripes only slightly darker than the yellow stripes themselves. The distinct dorsal keel is lighter in color than the rest of the back and in some individuals there is a definite dorsal stripe. The distinctly tripartite sole is irregularly dotted with black. These black dots are more numerous along the longitudinal grooves which separate the median area of the sole from the lateral areas.

HESPERARION HEMPHILLI (Binney)

Previously known only from Alameda and San Mateo Counties, the writer has found it to be quite widely distributed in

the wooded canyons in Los Angeles and Orange Counties. I have taken it in the following southern California localities: Elysian Park, Los Angeles; Arroyo Seco Canyon, Millard Canyon and Santa Anita Canyon, San Gabriel Mountains, Los Angeles County; Santa Ana Canyon, Black Star Canyon, Silverado Canyon and Trabuco Canyon, Santa Ana Mountains, Orange County.

Southern California specimens are somewhat darker along the dorsal area than specimens I have seen from the San Francisco Bay region but they have the characteristic markings on the sides and the milky white sole. Internally the structures agree with descriptions of the northern specimens.

BURCHIA, A NEW GENUS OF TURRIDS

BY PAUL BARTSCH

Thanks to the kind offices of Mr. Thomas A. Burch of Redondo Beach, California, I have been able to examine the animal of paratypes of the mollusks that he described (Nautilus, vol. 52, 1938, pp. 21-22) as *Pseudomelatomia semiinflata redondoensis*, dredged by him in 25 fathoms on gravel bottom off Redondo Beach. The placing of this mollusk was quite puzzling. In shell characters it suggests the African *Clionella*, whose type is *Buccinum sinuatum* Born. The radular structures, however, quite remove this from that relationship, for *Clionella* has a rachidian tooth as well as Y-shaped marginals, which places it in the subfamily Clavatulinae. Burch's mollusk, on the other hand, shows not a trace of a rachidian tooth, but possesses Y-shaped marginals only, a character that places it in the subfamily Turrinae. Since there is no genus in this subfamily to which *redondoensis* may be referred, I here propose for it the name:

BURCHIA, new genus

Shell large, turritid, covered by a strong periostracum. Nuclear whorls small (badly eroded in all our specimens). Post-nuclear whorls with a concave sinal area which extends over the posterior third of the turns. The anterior two-thirds are convex